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(22) 1995/12/04
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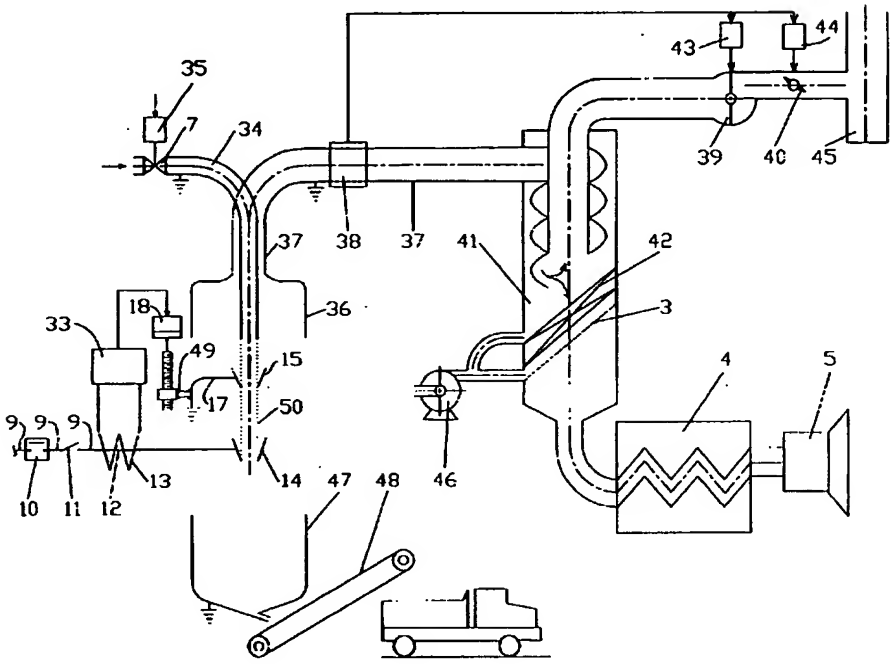
(54) METHODE ET APPAREILS POUR LE TRAITEMENT DES DECHETS LIQUIDES INDUSTRIELS ET MUNICIPAUX

(54) METHOD AND APPARATUS FOR TREATMENT OF INDUSTRIAL AND MUNICIPAL LIQUID WASTES



(57) L'invention porte sur une méthode et un appareil de traitement des eaux usées industrielles et municipales se servant des propriétés électroconductrices conjointement avec l'introduction d'un courant électrique pour rendre, d'une façon très économique, inoffensifs et/ou traitables les contaminants indésirables des fluides usés industriels, nucléaires et municipaux. L'écoulement supérieur passera à travers une électrode électroconductrice, réfractaire, tronconique, creuse et se déplaçant longitudinalement reliée à une mise à la masse. une certaine distance, se trouve une électrode identique qui est toutefois reliée à une source de courant alternatif à haute tension au moyen de plusieurs appareils électriques. Lorsque les électrodes se déplacent longitudinalement avec l'écoulement, c'est-à-dire elles se rapprochent ou s'éloignent l'une de l'autre, elles changent la densité électrique de ce dernier et, par le fait même, l'intensité de la vapeur de cycle direct provenant d'un

(57) A method and apparatus for the treatment of industrial and municipal waste waters is disclosed which utilizes electro-conductive properties in conjunction with the introduction of an electric current to render harmless and/or manageable in a very cost-effective manner the undesirable contaminants in industrial, including nuclear, and municipal waste fluids. The above flow will be passed through a hollow truncated-conic refractory electro-conductive movable-along-the-flow electrode connected with a ground and at a distance there is situated an identical electrode but connected via several electrical apparatuses with a terminal of an alternating high-voltage energy source. When the electrodes are moved along the flow, i.e. closer together or further apart, they change the electric density in it and thus the intensity of direct-cycle steam from a flow. In the presence of an electric arc (maximum current) in a flow, there is total disintegration of a flow. In this case

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écoulement. En présence d'un arc électrique (courant maximal), l'écoulement se désintègre complètement. Dans ce cas, sous l'influence de la température élevée d'un arc et de l'air ambiant, la teneur en matière organique du combustible brûle, la teneur en minéraux se cristallise, l'eau se transforme en vapeur, les contaminants dangereux et toxiques sont dégradés thermiquement, les pathogènes et les micro-organismes sont éliminés par stérilisation, et il s'effectue une précipitation des résidus cristallins, le tout s'exécutant simultanément dans l'écoulement. Tous ces éléments, sauf les résidus, forment un flux-vapeur de fumée, de brume, de microcristaux, d'ions métalliques, de vapeur, de gouttelettes d'eau, etc. Ce flux, qui est aspiré, est introduit dans un cyclone où la fumée séparée est dirigée vers une cheminée, et où le reste du flux passe dans la partie inférieure du cyclone à travers une couche de filtration à treillis métallique et une membrane poreuse où il est soumis à la séparation de ses composants, c'est-à-dire que les contaminants sont redirigés vers un réseau d'égouts et que la vapeur d'eau sera refroidie plus tard, prête à être utilisée. Lorsque cette méthode de traitement est adoptée par les stations d'épuration des eaux usées produites par une centrale nucléaire, toute autre usine industrielle ou une station d'épuration des eaux d'égout, par exemple, un évaporateur est simplifié, et les différents réservoirs et l'incinérateur ne sont plus nécessaires. L'exploitation des stations d'épuration des eaux usées peut alors être grandement simplifiée.

under the influence of an arc's high temperature and ambient air, simultaneously in the flow the fuel-organic content is burnt out, the mineral content is crystallized, the water content is turned into steam, the hazardous and toxic contaminates are thermal degraded, pathogens and microorganisms are sterilized and there is a precipitation of crystalline residue. Together the whole of this, except the residue, form a vapour-flow of smoke, mist, minute crystals, metal ions, steam, water droplets, etc. This flow being sucked up is introduced into a cyclone where the separated smoke is directed to a stack and the remaining flow passing into the cyclone's lower part through a wire mesh packed layer and a porous membrane where the flow is subjected to the separation of its constituents, i.e. the contaminants are direct back to a sewage system and the water steam will be cooled further on, ready for use. When this method for treatment is adopted in plants for disposal of waste water produced from a nuclear power station and any other industrial plant or a municipal sewage treatment plant, for instance, an evaporator is simplified, various tanks and incinerator are dispensed with and thus the plants for the disposals can be simplified to a large extent.

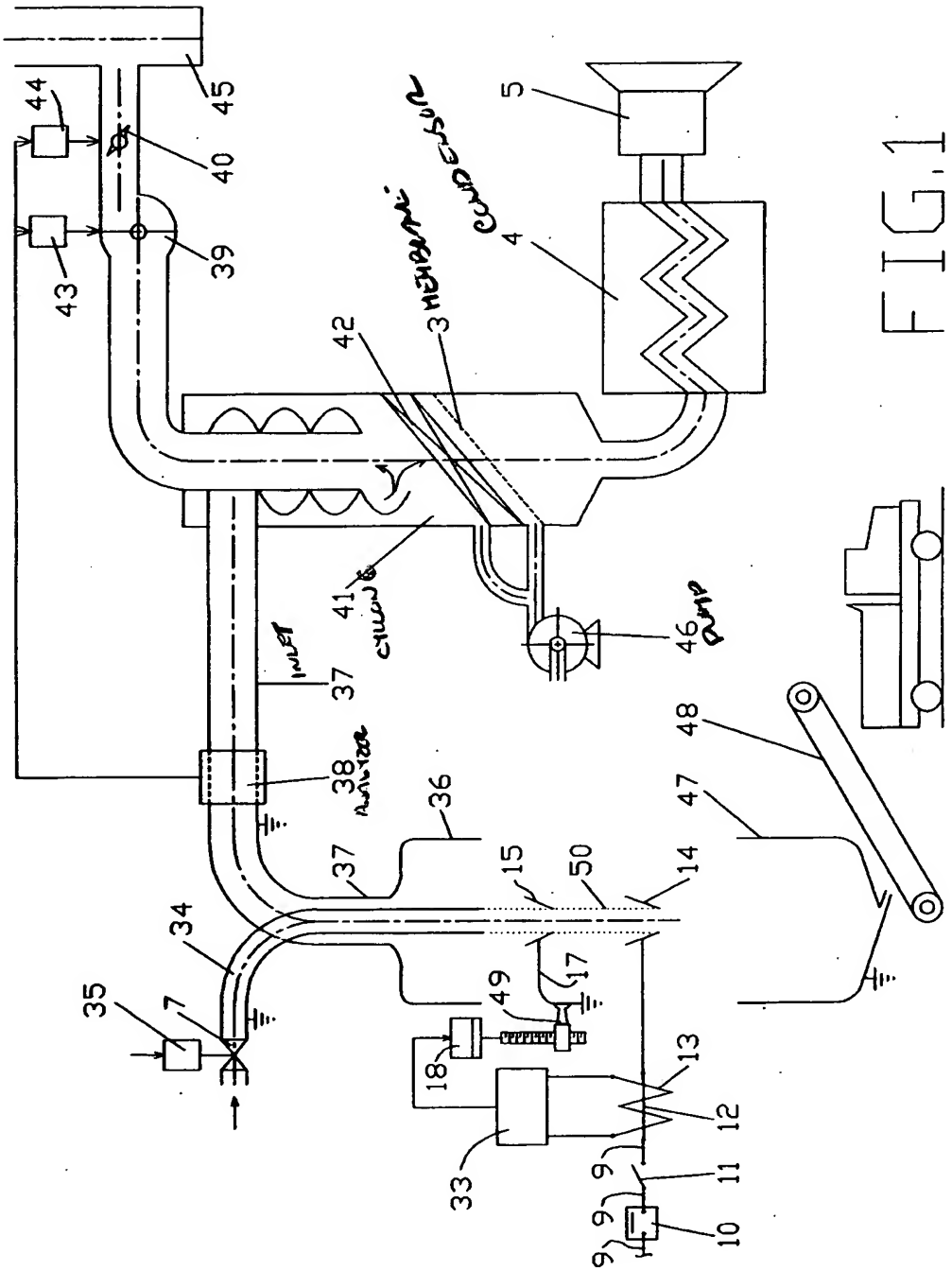
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FIG. 1

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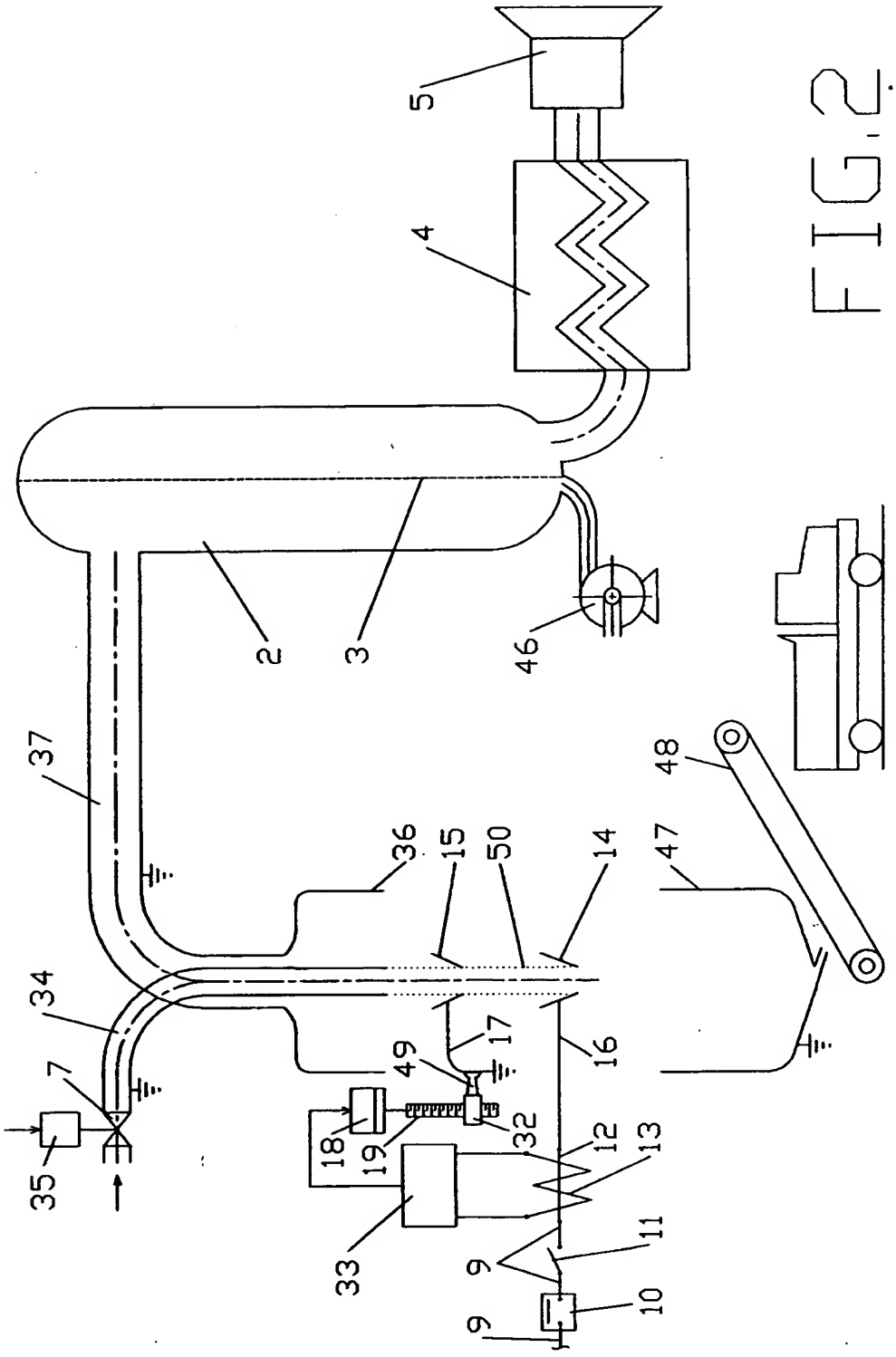

FIG.2

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FIG.3
(prior art)

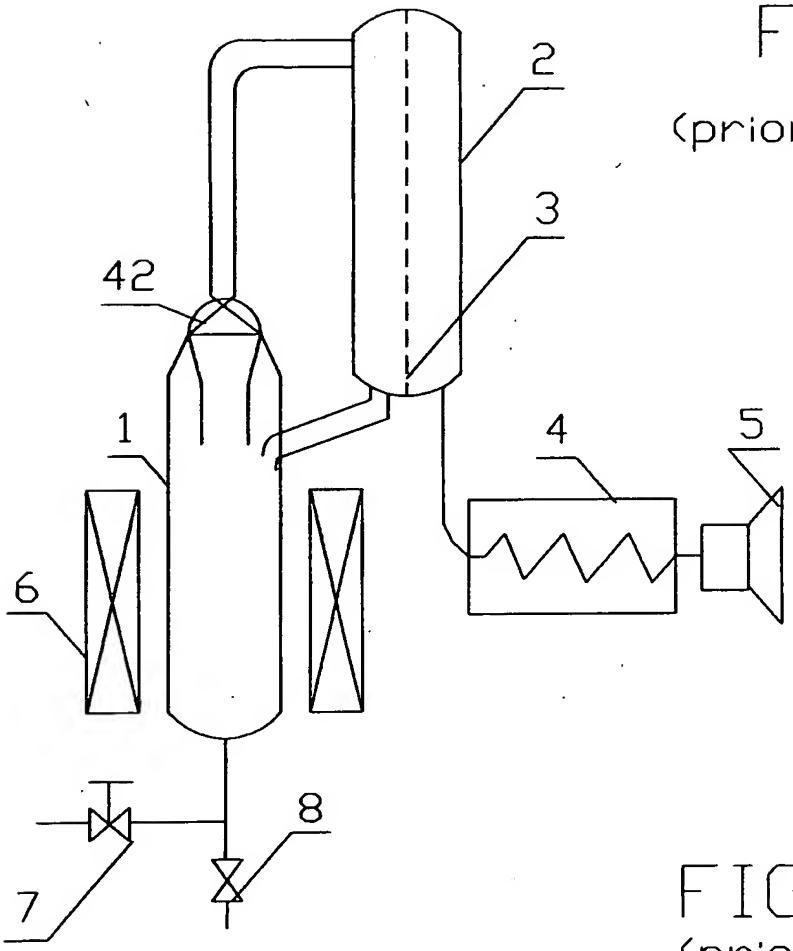
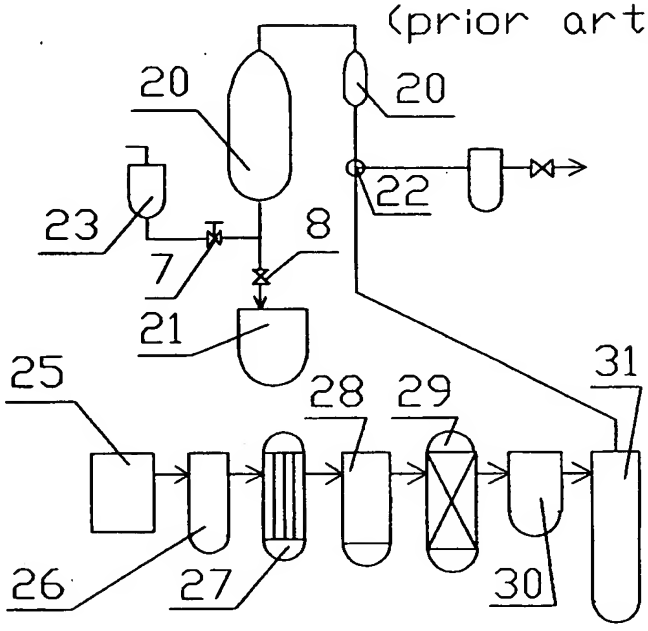


FIG.4
(prior art)



ABSTRACT OF THE DISCLOSURE

A method and apparatus for the treatment of industrial and municipal waste waters is disclosed which utilizes electro-conductive properties in conjunction with the introduction of an electric current to render harmless and/or manageable in a very cost-effective manner the undesirable contaminants in industrial, including nuclear, and municipal waste fluids. The above flow will be passed through a hollow truncated-conic refractory electro-conductive movable-along-the-flow electrode connected with a ground and at a distance there is situated an identical electrode but connected via several electrical apparatuses with a terminal of an alternating high-voltage energy source. When the electrodes are moved along the flow, i.e. closer together or further apart, they change the electric density in it and thus the intensity of direct-cycle steam from a flow. In the presence of an electric arc (maximum current) in a flow, there is total disintegration of a flow. In this case under the influence of an arc's high temperature and ambient air, simultaneously in the flow the fuel-organic content is burnt out, the mineral content is crystallized, the water content is turned into steam, the

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hazardous and toxic contaminates are thermal degraded, pathogens and microorganisms are sterilized and there is a precipitation of crystalline residue. Together the whole of this, except the residue, form a vapour-flow of smoke, mist, minute crystals, metal ions, steam, water droplets, etc. This flow being sucked up is introduced into a cyclone where the separated smoke is directed to a stack and the remaining flow passing into the cyclone's lower part through a wire mesh packed layer and a porous membrane where the flow is subjected to the separation of its constituents, i.e. the contaminants are direct back to a sewage system and the water steam will be cooled further on, ready for use. When this method for treatment is adopted in plants for disposal of waste water produced from a nuclear power station and any other industrial plant or a municipal sewage treatment plant, for instance, an evaporator is simplified, various tanks and incinerator are dispensed with and thus the plants for the disposals can be simplified to a large extent.

METHOD AND APPARATUS FOR TREATMENT OF INDUSTRIAL AND MUNICIPAL WASTE WATERS

FIELD OF INVENTION

The method and apparatus for treatment of industrial and municipal waste waters claimed herein relates to environmental engineering, particular waste and municipal concentrating methods, waste and municipal concentrating apparatus, and waste and municipal concentrating plants which are fit for removing a water content from waste and municipal disposals using methods and apparatuses for sedimentation, filtration, separation, purification, disinfection, incineration, and evaporation.

BACKGROUND OF THE INVENTION

One of the most significant problems of environmental engineering is the treatment of industrial and municipal wastes

without any detrimental effects to the surrounding environment. The characteristics of waste waters generated by various industrial processes vary greatly in their contents which makes it difficult for dewatering of these waste waters. It requires additional electro-chemical and mechanical processes which are not always one hundred percent effective in removing the hazardous and toxic materials and the cost of these additional processes is substantial and prohibitive. Additionally, in many instances, there is no electro-chemical or mechanical process to neutralize the toxic or hazardous materials and they are therefore merely filtrated from the sludge and stored by the industrial processor or transported to a designated site for storage. Still further, there are no methods and apparatus for disposal of mixtures of waste water and sewage which contain hazardous and toxic substances together with pathogens and micro-organisms.

In recent years, a large amount of research has been directed to the development of economically feasible methods and apparatuses for treatment of industrial and municipal waste waters. In this connection, among the more important avenues of research are those which have concentrated upon the concentration of waste water disposal coming out of a nuclear power station,

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U. S. Patent # 5028298.

The waste water concentrator which is used in the above patent and shown in FIG. 3 consists of an evaporator 1 wherein steam is generated by heating of waste water by a heater 6, a membrane demister 2 as a mist separator which has a functional membrane 3. In the upper part of the evaporator 1, a vapour-liquid separator 42 is provided for preventing bumping and the like. There are a condenser 4, an eductor 5 for generating a pressure difference, and also a valve 7 on the supplying tank side and a take-out valve 8 for taking out concentrated waste water. Waste water of high electro-conductivity is introduced into the evaporator 1 from a tank 23 through the supplying side valve 7.

Thus, the concentration of waste water is brought about by indirect heating which is ineffective. The process of concentration is used only for the definite disposal, waste water of high electro-conduction, and the process has no programmed control.

The main process, concentration of waste water is invisible like others.

Not shown are safety appliances and measures against accidental increasing of pressure in an evaporator 1 when accidentally an eductor 5 is cut off and a heater 6 goes on

heating of an overfilled evaporator 1 that may cause its explosion.

The above waste water concentrator demands individual manufacturing of an evaporator 1, a demister 2, and a heater 6 is a very complicated installation.

The embodiment where a system of disposal is built by using this prior-art waste water concentrator is shown in FIG. 4 and consists of a collecting tank 23 where the waste water with high electro-conductivity coming out of the nuclear power plant is collected; waste water concentrator 20; separator 22; collecting bath 25 where the waste water with of low electro-conductivity coming out of the machinery drain is collected; tanks 26; filter 27; tank 28; demineralizer 29; sample bath 30; storage tanks 21, 26 and 31; by-pass valves 7,8,24.

Thus, there is a necessity to have the second parallel line with a great number of successively jointed tanks for disposal of the waste water with low electro-conductivity that increases the cost of the whole.

OBJECT OF THE INVENTION

The objective of the present invention is to provide a novel, continuos, and unified method and apparatus as a plant for

treatment of industrial and municipal waste waters and their mixtures which enable the total disintegration thereby eliminating many processes for treatment of liquid disposals and are operable with simple processes, high reliability, and low price or overheads for a long time.

The second objective of the present invention is to furnish a method and apparatus as a plant for treatment of industrial and municipal waste waters and their mixtures which will enable the attainment of separation of water steam with high decontamination factor from the rest of the contents of the vapour-flow.

The third objective of the present invention is to simplify plants for disposals, for instance, of waste water from a nuclear power station or any other industrial plant, or a municipal sewage treatment plant.

SUMMARY OF THE INVENTION

The present invention provide a novel and continuous method and apparatus as a plant for treatment of industrial and municipal liquid wastes and their mixtures, considering them as electrolytes; using these properties of electro-conductivity the wastewater flow which is directed to electrodes with different potentials thus closing the high-voltage circuit of an alternating energy source until the flow begins absorbing the

electric energy.

If by chance the flow is cut off, the circuit is broken. By changing the length of a flow while being under the influence of an alternating high voltage and without changing the power and voltage of an electric power source, it is possible to change the power of the electric current in the wastewater flow, being under the high voltage, and thus the intensity of direct-cycle steam . For this reason, the flow is passed via a hollow truncated-conic refractory movable-along-the-flow electro-conductive electrode connected with a ground and at a distance there is situated an identical electrode but connected through electric apparatuses with a terminal of an alternating high-voltage energy source. Electrodes may be moved along the flow for regulation of electric current there. Thus, by moving them apart or closer together, the current and, consequently, evaporation of a wastewater flow is reduced or increased. For greater safety it would be better to have a movable installation only for the grounded electrode. Maximum current, i. e. an electric arc, in a flow gives the total concentration of a flow which is under the influence of a high voltage. In this case, under the influence of an arc's high temperature and ambient air, the fuel-organic content of a flow is burnt out, the mineral content is crystallized, the water

content is turned into steam, the hazardous and toxic contaminants are thermal degraded, pathogens and microorganisms are sterilized and there is a precipitation of crystalline residue.

Thus, the flow creates and keeps up the electric arc and simultaneously the arc disintegrates it. In accordance with the foregoing facts, the creation of a wastewater flow, the directing of the flow relative to the electrodes with different potentials (grounded and under the voltage) for the purpose of commutating of circuit and absorption of energy, regulation of the density of electric current in the flow as far as possible of its total disintegration with evaporating, burning out, crystallizing, and disinfection of all contents unify many processes and apparatuses for the treatment of industrial and municipal waste waters and their mixtures and give a chance to avoid using them. In addition, the main process, i.e. disintegration of a wastewater flow, has a field of view.

Another positive characteristic of the present invention in connection again with the disintegration of a wastewater flow, is a production of a direct-cycle water steam from a flow due to there being an arc, that means the direct heating of a stream without inter-mediate stages, this gives the most simple and

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efficient process and apparatus for the concentration of waste waters.

In addition to the above, the disintegration of a flow abolishes many processes for treatment of waste waters such as sedimentation, filtration, purification, disinfection, electrochemical disintegration, incineration, and evaporation because this procedure has contained within it all of the above processes.

And what is more, the discharge of a wastewater flow on electrodes and cutting it off are accordingly the switching on and disconnecting of a circuit of energy source. That sort of self-commutation abolishes a switchgear.

Also, the present invention employs the refractory electroconductive electrodes, for instance, made from a ceramic-metal-matrix material which has a protective property against the rapid therm-arc destruction. The hollow truncated-conic form of the electrodes allow the flow to pass well without any dispersion, this gives a reliable electric contact of the flow with the electrodes. The employment of an alternating electric energy source protects the water and its steam from their electrolysis which liberates hydrogen and oxygen gases and compromises the reliability and safety.

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The transition of a liquid to a vaporous state under the influence of an electric arc in a wastewater flow signifies the beginning of a large number of small-capacity series-parallel-combined capacitors through which run capacitive currents.

It is known from electrical engineering practice that an electric arc has an inductive current and the above effect compensates for it.

Thus, the energy of an electric source is spent only for heating of a wastewater flow which means the electric load (the flow of the electrolyte) of a circuit which has a resistive load and the energy source gives its active power and therefor high efficiency.

All of these in sum make the present invention operable with simple processes and apparatus and provide high reliability at low cost for a long time.

For preservation of the environment from contents of disintegration (vapour-flow) of a wastewater flow and removal of the water steam from them, the vapour-flow being sucked up is introduced into the pipe-line where there is installed the gas analyser making a qualitative analysis of the passing vapour-flow and gives, according to the analysis, proper signals to the programmed control mechanism which sends control commands for

commutation of a starting electric device of a ventilator of which an inlet elbow is joined with an outlet of a cyclone and the ventilator's outlet is joined, through a throttle valve having its drive controlled by the above programmed control mechanism, with a stack.

Accordingly, the above function of a gas analyser, the vapour-flow with smoke (products of combustion) introduced into a cyclone is separated from its smoke which is directed by a ventilator into a stack. The remaining vapour-flow is directed into the lower part of a cyclone to the wire mesh packed layer, which is installed at an angle, where the water droplets, ion metals, and the like are separated from the remaining flow, which is introduced further down into a hydrophobic porous membrane installed at an angle, having the property to allow water steam to permeate but does not allow water, mist, ions, etc. to do so, and thereby only the pure vapour of water is made to permeate. Separated mist, ions, etc. are sucked off by a transfer pump into the sewage system to be introduced again into a process for treatment of liquid wastes. Meanwhile, the water steam separated by a membrane is restored to water droplets by a condenser one side of which connected with the low part of the cyclone and the another one with the eductor to be collected, reused or

abandoned.

For industrial waste water without fuel-organic contents there is no necessity to have a cyclone, ventilator, and stack. In this case, the vapour-flow, being under the ventilator cowl, is sucked in by an eductor and is directed into the pipe-line the other side of which connected with a demister inside which is installed a hydrophobic porous membrane that has the above mentioned property. The separated water steam is turned into water droplets by a condensator joined on one side with a demister and on the other one with an eductor. Separated mist, ions, etc. are sucked off by a transfer pump in the sewage system to be introduced again into a process for treatment of waste waters.

Moreover, the present invention simplifies the waste water disposal plant of a nuclear power station by using the above unified method for treatment of waste waters due to the electric arc in the wastewater flow thereby substituting processes and apparatuses for concentration of waste waters and crystallization of its mineral contents. At the same time, industrial waste waters, municipal sewages, and their mixtures having other chemical and organic compositions, the same electric arc additionally and simultaneously substitutes processes and apparatus for incineration of fuel-organic contents, thermal

degradation of hazardous and toxic contaminates, and sterilization of pathogens and microorganisms.

Thus, creation of an electric arc in a flow of liquid waste replaces all processes and apparatuses for disintegration of any kind of liquid waste which means that any type of waste water disposal and municipal sewage treatment plant can be simplified to a large extent.

BRIEF DESCRIPTION OF DRAWINGS

FIG.1 is a sectional view showing one embodiment of the present invention when it is used for treatment of waste waters having fuel-organic and other contents with hazardous and toxic contaminates as well as pathogens and microorganisms.

FIG.2 is a sectional view showing another embodiment of the present invention when it is used for treatment of waste waters which in the process of disintegration has no smoke, in particular, coming from a nuclear power plant.

FIG.3 is a sectional view of a prior-art waste water concentrator.

FIG.4 is a flow sheet showing of a prior-art invention when it is used for disposal of waste water coming out of a nuclear power plant.

DESCRIPTION OF THE PREFERRED EMBODIMENT

When used throughout this specification, the term "wastewater" is water discharged from homes, business, and industries that contains dissolved, suspended, and particulate inorganic or organic materials, having a vide range of liquid content from 99.99% till 50%, and including also the conceptions of sewage and sludge.

Embodiment of the present invention will be described in detail hereunder with drawings supplied. A description will be made on the summary of a plant, FIG.1.

Basically, the plant consists of three elements.

The first element is a device where disintegration takes place with a sanitary treatment of a wastewater flow, or otherwise disposal flow. This device consists of: current feeding equipments (high-voltage busbars 9; single-phase oil-switch 10; single-pole air-break switch 11); current measuring equipment (high-voltage current transformer with primary 12 and secondary 13 windings); equipment for disintegration with sanitary treatment of disposal flow (high-voltage 14 and grounded 15 electrodes accordingly with windings 16 and 17); shifting mechanism (servo-motor 18, its feed screw 19, and nut 32) of electrode 15; programmed control mechanism 33 and outlet 34 of liquid waste with magnetic valve 7 and its drive 35. Note:

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electrodes 14 and 15 having hollow truncated-conic form made from electro-conductive refractory material, for instance, ceramal.

The second element is a device where separation of other contents from the water steam takes place with a subsequent restoration of the steam to water droplets. This device consists of: a ventilator cowl 36; inlet pipe-line 37; gas analyser 38 with its programmed control mechanism of a ventilator 39 and throttle valve 40; cyclone 41 with internal installation of a liquid-vapour separator 42 and porous membrane 3; smoke sucking-off ventilator 39 with its drive 43; throttle valve 40 with its drive 44; stack 45; pump 46 for sucking off separated contents; condensator 4 for restoration of water steam to water droplets; eductor 5 for sucking in vapour-flow and hopper 47 for collecting crystalline residue and loading it on a conveyor 48.

The third element, safety appliance, consists of: a high-voltage insulator 49; ground connections of an electrode 15, outlet 34, inlet pipe-line 37 and a hopper 47.

The treatment of waste water is brought about in the way described below.

When a need arises to eliminate waste water, the starting command is send to the drive 35 opening the magnetic valve 7. Liquid waste from its source enters to the outlet 34. The

wastewater flow coming out of an outlet 34 passes through a grounded electrode 15 and hits an electrode 14. In this case there appears an electric current moving in consecutive order in the circuit consisting of an alternating high-voltage energy source, not shown in the drawing, a busbar 9, an oil-switch 10, a busbar 9, an air-break switch 11, a busbar 9, primary winding 12 of a current transformer, wiring 16, an high-voltage electrode 14, a flow 50, grounded electrode 15.

Thus, the flow, as an electrolytic substance and electrical swamping variable resistance because of its merging property of an electric energy and the possibility of changing the length of a flow concluded between electrodes 15 and 14, can be disintegrated by its strong electric current, an electric arc is gotten in the following way. The secondary winding 13 of a current transformer gives the quantity of a current in the above circuit to the programmed control mechanism 33 where the present current is compared with, requiring for a concrete apparatus, the programmed current of disintegration of a flow and the mechanism 33 issues a control command to the servo-motor 18 to establish a programmed distance between the electrodes 15 and 14 revolving the feed screw 19 which is joined with a servo-motor 18 and coupled with a nut 32 where there is installed a high-voltage

insulator 49 and a grounded electrode 15 with its busbar 17. Because of the above, the flowing-out waste water turns into vapour-flow and discharges the crystalline residue to be collected in a hopper 47 followed by loading it on a conveyor 48.

With respect to the vapour-flow being under a ventilator cowl 36, it is sucked in by an eductor 5 into a pipe-line 37 and passed through an installed gas analyser which when making a qualitative analysis of a vapour-flow gives according to this analysis the proper signals to its programmed control mechanism which sends control commands for commutating of a starting electric device 43 of a ventilator 39 and drive 44 of a throttle valve 40. Note: The gas analyser and its programmed control mechanism is shown in the drawing under the one conventional sign with a number 38.

Thus, introduced into a cyclone 41 the vapour-flow with smoke (products of combustion of a fuel-organic content of a flow) is separated from the latter, which, according to the above function of a gas analyser, is sucked up by a ventilator 39 and passed through a throttle valve 40 into a stack 45. The remaining vapour-flow continues being sucked in by an eductor 5 and is passed through the lower part of a cyclone 41 to the wire mesh packed layer 42 which is installed at an angle, known publicly

and employed as a separator and where the water droplets, ions, and the like are separated from the remaining flow, which is passed further down to a porous membrane 3 installed at an angle which has the property of allowing water steam to permeate but not allowing water, salt, mist, etc. to do so, and thereby only the pure vapour of water is made to permeate. Water droplets, salt, mist, ions, etc. filtered by a layer 42 and membrane 3 are sucked off by a transfer pump 46 in the sewage system (disposal source) to be introduced again into a process for treatment of waste water. Meanwhile, the water steam separated by a membrane 3 is restored to water droplets by a condenser 4 to be collected, reused or abandoned.

The vapour-flow without smoke is passed successively through a wire mesh packed layer 42, membrane 3, condenser 4 where the above separation and cooling processes take place and, according to the above function of a gas analyser, the stack ventilator 39 is switched off and the throttle valve 40 is shut (vertical posture).

The broken circuit of a drive 1 shuts off the waste water and stops the treatment.

Embodiment of the present invention for treatment of waste water which has no smoke in the process of disintegration is

shown in FIG.2 consists of three elements also.

The first element has the conventional signs and purposes as the first one in FIG.1 has.

The second element consists of a demister 2 of which porous membrane 3 has the above property of a membrane 3 in FIG.1.

The third element has as conventional signs and purposes as the third one of FIG.1 has.

When used throughout this specification, the term "treatment of waste waters withought smoke" is used to denote "treatment of waste waters which have no smoke in the process of disintegration".

The treatment of waste waters without smoke shown in FIG.2 is brought about in the way described for FIG.1 with the difference that the paragraph beginning with words "With respect to the vapour-flow being under a ventilator cowl 36, it is sucked in by an eductor 2 into a pipe-line 37 " has a following continuation as "and passed through the porous membrane 3 of a demister 2 where mist, water droplets, a minute quantity of salt, ions, etc. filtered by a membrane 3 are collected again to the disposal source by a transfer pump 46. The water steam separated by a membrane 3 is restored to water droplets by an eductor 4 to be collected, reused or abandoned".

The installation shown in FIG.2 is also a plant for disposal of waste water produced from a nuclear power station, totally replacing the prior-art plant shown in FIG.4 and having a simple construction compared to it. It also eliminates all said negative qualities of the prior-art plant in FIG 4.

Thus, a procedure and apparatus is disclosed which utilizes electro-conductive properties in conjunction with the introduction of an electric current to render harmless and/or manageable in a very cost-effective manner the undesirable contaminants in industrial, including nuclear, and municipal waste fluids.

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What is claimed is:

1. A method for treatment of industrial and municipal waste waters which comprises:

(a) discharging of a flow of said waste waters on the electrodes with different potentials just at the beginning of liquid disposals;

(b) closing of electrodes by a wastewater flow just as a commutation (switching on) of a circuit of an energy source and beginning of merger of electric energy;

(c) shifting of an electrode along a wastewater flow just as an adjustment of intensity of absorption of electric energy by a wastewater flow that equivalents regulation of intensity of heating of a wastewater flow which can be realized taking the electric current quantity in the circuit including the wastewater flow under the alternating high voltage passing through the high-voltage current transformer being joined via its primary winding

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with the above circuit and giving through its secondary winding the quantity of electric current in a wastewater flow to the programmed control mechanism which gives control commands to the servo-motor for revolving of its feed screw coupled with a nut on which is installed a high-voltage insulator with a grounded electrode;

(d) increasing of electric current in the wastewater flow due to narrowing of the gap between the electrodes until the appearance of an electric arc in the wastewater flow that means the origin of disintegration of a wastewater flow which includes simultaneous evaporation of the water content, incineration (burning out) of fuel-organic contents, crystallization of a mineral content, neutralization (therm-degradation by an arc) of hazardous and toxic contaminates, disinfection (sterilization by an arc) of pathogens and micro-organisms and there also is a precipitation of crystalline residue;

(e) sucking in by an eductor the vapour-flow (products of disintegration) being under a ventilator cowl into a pipe-line where the gas analyser is installed making a quantative analysis of the passing vapour-flow and gives, according to the analysis, signals to the programmed control mechanism the control commands for commutation of a starting electric device of a ventilator of

which an inlet elbow is connected to an outlet of a cyclone and the ventilator's outlet is connected to a stack through a throttle valve having its drive controlled by the above programmed control mechanism.

According to the signals from the gas analyser, the vapour-flow and smoke (products of combustion) introduced into a cyclone are separated, the smoke is directed by a ventilator into a stack; the remaining vapour-flow continues being sucked in by an eductor and is directed through the lower part of a cyclone to the wire mesh packed layer where the water droplets, metal ions and the like are separated from the remaining flow which is passed down to a hydrophobic porous membrane having the property to allow water steam to permeate but does not allow water, mist, ions, etc. to do so, and thereby only pure vapour of water is made to permeate. Separated mist, ions, etc. are sucked off by a transfer pump into a sewage system to be introduced again in a process for treatment of waste water.

Meanwhile, the water steam separated by a membrane is restored to water droplets by a condenser the one side of which is connected with the low part of a cyclone and the other one with the eductor to be collected, reused or abandoned. The vapour-flow without smoke is passed successively through a wire mesh packed

layer, membrane and condenser where the above separation and cooling processes take place and, according to the function of a gas analyser, the stack ventilator is switched off and the throttle valve is shut (vertical posture).

(f) cutting off a flow just as a commutation (switching off) of a circuit of energy source and the stopping of treatment of waste water.

2. A method for treatment of waste waters without smoke which comprises:

(a) discharging of a flow of said waste waters on the electrodes with different potentials just at the beginning of liquid disposals;

(b) closing of electrodes by a wastewater flow just as a commutation
(switching on) of a circuit of an energy source and beginning of merger of electric energy;

(c) shifting of an electrode along a wastewater flow just as an adjustment of intensity of absorption of electric energy by a wastewater flow that equivalents regulation of intensity of heating of a wastewater flow which can be realized by taking an electric current quantity in a circuit including a wastewater flow under an alternating high voltage passing through a high-

voltage current transformer being joined by its primary winding with the above circuit and giving through its secondary winding a quantity of electric current in a wastewater flow to a programmed control mechanism which gives control commands to a servo-motor for revolving its feed screw coupled with a nut on which is installed a high-voltage insulator with a grounded electrode;

(d) increasing of electric current in the wastewater flow due to narrowing of the gap between the electrodes until the appearance of an electric arc in the wastewater flow which means the origin of disintegration of a wastewater flow which includes simultaneous evaporation of a water content, crystallization of the mineral content, neutralization of hazardous and toxic contaminates, disinfection of pathogens and microorganisms and there is a precipitation of crystalline residue;

(e) exhausting the vapour-flow, being under the ventilator cowl, by an eductor into the joined pipe-line the other side of which is connected with a demister provided with a porous membrane which has the property of allowing water steam to permeate but not allowing other contents to do so and thereby only the pure vapour is made to permeate and further the water steam is turned into water droplets by a condensator jointed on the one side with a demister and on the other one with an

eductor;

(f) sucking off, i.e. not-let-pass-via-a-membrane contents, of the flow;

(g) cutting off a stream directed on an electrodes just as the switching off a current of energy source and stopping of treatment of waste waters.

3. An apparatus as a plant for treatment of industrial and municipal waste waters and their mixtures which comprises:

(a) a single-phase oil-switch for emergency commutation, repair and preventive measures on a phase joined with an electrode and its electro-power wiring and installation;

(b) a single-pole air-break switch for repair and preventive measures and operative switching on a phase jointed with an electrode and its electro-power wiring and installations;

(c) a hollow truncated-conic refractory electro-conductive movable-along-the-flow coaxial with an under alternative high-voltage electrode and wastewater's outlet grounded electrode for guaranteeing a zero potential on a flow in this place;

(d) a hollow truncated-conic refractory electro-conductive coaxial with a grounded electrode and wastewater's outlet high-voltage electrode for guaranteeing of an alternative high voltage on a wastewater flow in the place and merging by a

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wastewater flow of electric energy;

(e) a servo-motor with its commutation apparatus changing revolutions of a motor and its screw coupled with a nut on which is installed a high-voltage insulator with a grounded electrode and changing the density of electric current in a wastewater flow;

(f) a high-voltage current transformer for measuring and giving out through its secondary winding the quality of current in a wastewater flow;

(g) a programmed control mechanism taking the quantity of current in a flow by a secondary winding of a current transformer and issuing control commands to control a commutation apparatus for a servo-motor;

(h) a ventilator cowl for temporarily holding a vapour-flow till it will be exhausted;

(i) an outlet of waste water passing into a pipe-line that has a coaxial posture there and is provided with a drive for feeding of a wastewater flow;

(j) an inlet pipe-line joined at the beginning with a ventilator cowl and at the end with a cyclone to which is directed the vapour-flow;

(k) a gas analyser set into a pipe-line for controlling

through its programmed control mechanism a starting electric device of a ventilator and a drive of a throttle valve;

(l) a cyclone (first device) inside of which is set in its lower part at a distance from each other a vapour-liquid separator (second device) and porous membrane (third device): the first device for separation of smoke and directing it through the upper outlet joined there with a ventilator which exhausts this smoke, the second and third ones are for separating water droplets, mist, salt, ions, and the like from the water steam which is directed through the lower outlet joined there to a condensator by an eductor which is joined to the other side of a condensator;

(m) a condensator for restoring of water steam to water droplets;

(n) an eductor for sucking off the vapour-flow;

(o) a ventilator for sucking off the smoke and directing it via a throttle valve to a stack;

(p) a transfer pump of which the inlet elbow is joined via two parallel pipes with the lower parts of a vapour-liquid separator and porous membrane for transferring separated and collected contents of vapour-flow to a sewage system (wastewater source);

(r) a hopper for collecting solid residue and loading it on a

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conveyor.

4. An apparatus as a plant for treatment of waste waters withought smoke, in particular, as a plant for disposal of waste water produced from a nuclear power station which comprises:

(a) a single-phase oil-switch for emergency commutation, repair, and preventive measures on a phase joined with an electrode and its electro-power wiring and installations;

(b) a single-pole air-break switch for repair and preventive measures and operative switching on phase joined with an electrode and its electro-power wiring and installations;

(c) a hollow truncated-conic refractory conductive movable-along-the-wastewater-flow grounded electrode, which is coaxial with an under alternative high-voltage electrode and liquid waste's outlet and which is for guaranteeing a zero potential on a wastewater flow in this place;

(d) a hollow truncated-conic refractory conductive high-voltage electrode, which is coaxial with a grounded electrode and a wastewater's outlet and which is for guaranteeing of an alternative high-voltage on a wastewater flow in the place and merging by a wastewater flow of an electric energy;

(e) a servo-motor with its commutation apparatus for changing the revolutions of a motor and its feed screw coupled with a nut

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on which is installed a high-voltage insulator with grounded electrode which when moved relative and co-linear to the other electrode changes the density of electric current in the wastewater flow;

(f) a high-voltage current transformer for measuring and giving out via its secondary winding the quantity of current in a wastewater flow;

(g) a programmed control mechanism taking the quantity of current in a wastewater flow via a secondary winding of a current transformer and issuing control commands to a commutation apparatus of a servo-motor;

(h) a ventilator cowl for temporary holding a vapour-flow till it will be sucked off;

(i) a wastewater's outlet passed into a pipe-line and has an coaxial posture there, and is provided with a drive for feeding of a wastewater flow;

(j) an inlet pipe-line joined at the beginning with a ventilator cowl and at the end with a demister into of which is directed the sucked-up vapour-flow;

(k) a demister the other side of which joined with a condensator and inside of the first installed a porous membrane for allowing water stream to permeate but not allowing the other

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contents to do so;

(l) a condensator for restoring of water steam to water droplets the other side of which jointed with an eductor for sucking up of a vapour-flow being under a ventilator cowl;

(m) a pump having an inlet elbow joined with the lower part of a demister and transferring separated and collected contents of flow to a wastewater source;

(n) a hopper for collecting crystalline residue and loading it on a conveyor.